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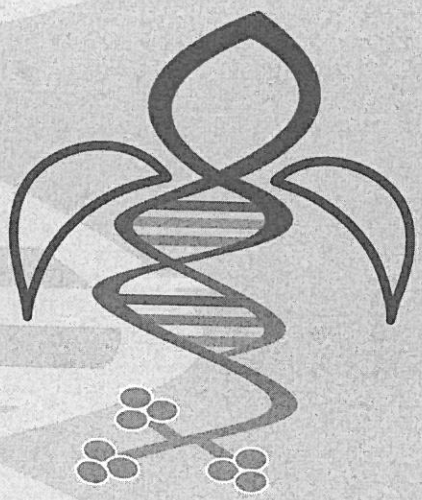

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UNIVERSITY OF COPENHAGEN

β-1,3-GLUCAN FROM *SEPTORIA TRITICI* ELICITS DEFENCE RESPONSES IN WHEAT

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OBJECTIVES

- **To investigate the involvement of PR-proteins in defence of wheat against *S. tritici* and the role of β-1,3-glucan as a PAMP/MAMP.**

BACKGROUND

- *Septoria tritici* (teleomorph *Mycosphaerella graminicola*), is a hemibiotrophic pathogen, causing speckled leaf blotch on wheat.
- Penetrates through stomata and grows intercellularly in the mesophyll and causes necrotic lesions. (Shetty *et al.* 2003, 2007).

CONCLUSIONS

- **Resistance correlates with PR-protein accumulation and callose deposition.**
- **β-1,3-glucan purified from the pathogen protects a susceptible wheat cultivar from disease development.**
- **Protection is accompanied by the accumulation of PR-proteins and callose.**
- **Resistance in Stakado (R) dependant on a rapid initial recognition of the pathogen, probably due to the presence of β-1,3-glucan in the fungal cell walls.**
- **In Sevin (S), the pathogen is not initially recognised and spreads unhindered.**

MATERIALS & METHODS

- Wheat cultivars Sevin (susceptible) and Stakado (resistant) to isolate IPO323 of *S. tritici* (Shetty *et al.* 2003;2007).
- Gene expression was studied by quantitative real-time qRT-PCR.
- Activity of β-1,3-glucanase was determined according to Kini *et al.* (2000) and chitinase activity according to Boller and Mauch (1988).
- β-1,3-glucan was purified from isolate IPO323 of *S. tritici* (Yamaguchi *et al.*, 2000).

RESULTS

TREATMENT OF WHEAT WITH PURIFIED β-1,3-GLUCAN (Fig. 1)

- Increased callose accumulation (data not shown)
- Reduced transcript levels of chalcone synthase (0.2 fold),
- Elevated levels of chitinase and β-1,3-glucanase (2.4 and 5.9 fold, respectively).

Table 1. Gene expression of β-1,3-glucanase and chitinase in whole leaf extracts.

	β-1,3-Glucanase (PR-2)		Chitinase (PR-3)	
Time	Stakado	Sevin	Stakado	Sevin
1 dai	4.5^{A}	1.4^{NS}	2.6^{NS}	0.9^{NS}
3 dai	4.1^{A}	1.1^{NS}	3.2^{A}	0.6^{A}
5 dai	2.9^{NS}	1.5^{NS}	1.6^{A}	1.5^{NS}
7 dai	1.0^{NS}	1.1^{NS}	1.0^{NS}	0.9^{NS}
9 dai	3.5^{A}	52.0^{A}	5.3^{A}	54.9^{A}
11 dai	2.9^{A}	48.8^{A}	0.5^{A}	3.3^{A}
13 dai	0.6^{A}	27.2^{A}	0.7^{NS}	317.4^{A}
15 dai	0.5^{A}	322.9^{A}	0.3^{A}	2846.6^{A}

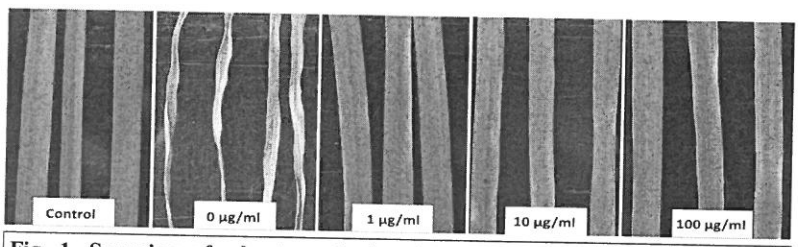

Fig. 1. Spraying of wheat cv. Sevin with purified β-glucan from *S. tritici* followed by inoculation with the pathogen 24 h later. Symptoms scored 19 dai.

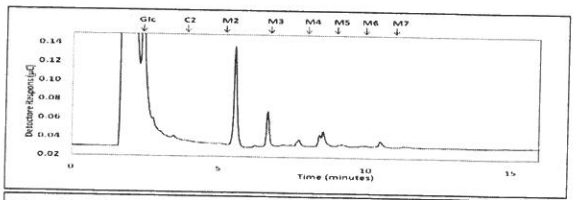

Fig. 2. HPAEC-PAD profile for the linear β-1,6-cello oligosaccharides

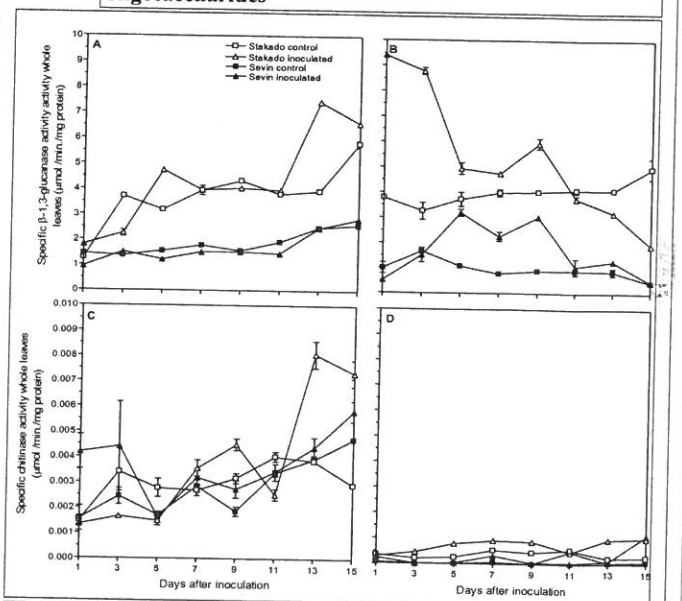

Fig. 3. Activity of β-1,3-glucanase and chitinase in whole leaf extracts and apoplastic fluid